



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: J. Daly et al.
Serial No: 10/081,655
Filing Date: February 22, 2002
Title: Absorption Spectroscopy Apparatus and Method
Docket No: 56326-039 (IOPL-118)

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Assistant Commissioner for Patents
Washington, DC 20231

PRELIMINARY AMENDMENT

Sir:

Please amend the above-identified application as follows:

In the Claims

Add new claims 23 through 44 as follows:

23. (New) A sample cell for an absorption spectroscopy apparatus comprising:

at least one side wall having,

a reflective surface facing inwardly with respect to an axis of the sample cell such that a beam of energy directed against a predetermined location on the reflective surface is reflected back and forth off the reflective surface and inside the sample cell, and

at least one port; and

end walls closing opposing ends of the side and having substantially flat reflective surfaces facing inwardly with respect to the cell and extending substantially normal with respect to the axis such that a beam of energy reflected back and forth off the reflective surface of the side wall and inside the sample cell remains in substantially the same plane while inside the cell.

24. (New) A sample cell according to claim 23, wherein the reflective surfaces of the end walls are polished.

25. (New) A sample cell according to claim 23, wherein the end walls are molded.

26. (New) A sample cell according to claim 23, wherein the reflective surface of the side wall is curved.

27. (New) A sample cell according to claim 23, wherein the reflective surface of the side wall has a circular profile in a plane extending parallel with the reflective surfaces of the end walls of the cell.

28. (New) A sample cell according to claim 23, wherein the reflective surface of the side wall has a flat profile in a plane extending parallel to the axis of the cell.

29. (New) A sample cell according to claim 23, wherein the side wall is molded.

30. (New) A sample cell according to claim 23, wherein the reflective surface of the side wall is polished.

31. (New) A sample cell according to claim 23, further comprising a light transmissive window positioned within the port of the side wall.

32. (New) A sample cell according to claim 23, wherein the cell has a height measured in a direction parallel to the axis substantially equal to a source length.

33. (New) An absorption spectroscopy apparatus including a sample cell according to claim 23, and further comprising at least one source/detector reflector having a curved profile in a plane extending perpendicular to the axis of the sample cell, the reflector positioned with respect to the port of the side wall of the sample cell to reflect energy through the port and against the predetermined location on the reflective surface of the side wall.

34. (New) An absorption spectroscopy apparatus according to claim 33, wherein the port of the side wall of the sample cell comprises inlet and outlet ports, and the source/detector reflector comprises separate source and detector reflectors corresponding respectively to the inlet and the outlet ports.

35. (New) An absorption spectroscopy apparatus according to claim 34, further comprising:

a source for directing energy against the source reflector; and

a detector for receiving energy from the detector reflector.

36. (New) An absorption spectroscopy apparatus according to claim 33, further comprising an intermediate reflector positioned with respect to the port of the side wall of the sample cell and the emitter/detector reflector to reflect energy from the emitter/detector reflector through the port of the cell and against the predetermined location on the reflective surface of the side wall of the cell.

37. (New) An absorption spectroscopy apparatus according to claim 34, further comprising:

a source for directing energy against the at least one source/detector reflector; and

a detector for receiving energy from the at least one source/detector reflector.

38. (New) An absorption spectroscopy apparatus according to claim 34, wherein the port of the side wall of the cell comprises a single inlet/outlet port, and the source/detector reflector comprises a single source/detector reflector, and the apparatus further comprises a source for directing energy against the source/detector reflector, and a detector for receiving energy from the source/detector reflector.

39. (New) An absorption spectroscopy apparatus according to claim 34, further comprising a source for directing energy against the at least one source/detector reflector, wherein the source provides infrared energy.

40. (New) An absorption spectroscopy apparatus according to claim 34, wherein the source/detector reflector comprises a segment of a cylinder.

41. (New) An absorption spectroscopy apparatus according to claim 34, wherein the source/detector reflector is polished.

42. (New) An absorption spectroscopy apparatus according to claim 34, wherein the source/detector reflector is molded.

43. (New) A sample cell according to claim 23, wherein a height of the cell defined between the end walls is relatively small compared to a width of the cell defined by the at least one side wall.

44. (New) A sample cell according to claim 43, wherein the width of the cell is at least twenty times greater than the height of the cell.

REMARKS

Claims 1-44 remain in the present application. By this amendment, new claims 23 through 44 have been added. Support for these amendments can be found in the specification and drawing figures as originally filed. No new matter has been added.

Attached hereto is a marked up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with Markings to Show Changes Made."

Applicants believe that all claims pending in the application are in condition for allowance and respectfully request such allowance. If a telephone conference will expedite prosecution of the application the Examiner is invited to telephone the undersigned.

Respectfully submitted,

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"Version with Markings to Show Changes Made."

(Deletions appear as bracketed text, and additions appear as underlined text.)

In the Claims

All claims are reproduced here for the convenience of the Examiner.

Add new claims 23 through 44 as follows:

1. An absorption spectroscopy apparatus having a fluid inlet and a fluid outlet and comprising:

a sample cell including an axis, a side wall having at least one curved reflective surface arrayed about the axis and facing inwardly with respect to the cell such that a beam of energy directed against a predetermined location on the reflective surface is reflected back and forth off the reflective surface and remains in substantially the same plane while inside the cell, and at least one port in the sidewall; and

at least one source/detector reflector having a curved profile in a plane extending perpendicular to the axis of the cell, the reflector positioned with respect to the port of the cell to reflect energy through the port of the cell and against the predetermined location on the reflective surface of the side wall of the cell.

2. An absorption spectroscopy apparatus according to claim 1, wherein the reflective surface of the side wall of the cell has a circular profile in a plane extending perpendicular to the axis of the cell.

3. An absorption spectroscopy apparatus according to claim 1, wherein the reflective surface of the side wall of the cell has a flat profile in a plane extending parallel to the axis of the cell.

4. An absorption spectroscopy apparatus according to claim 1, wherein the port of

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the side wall of the cell comprises inlet and outlet ports, and the source/detector reflector comprises separate source and detector reflectors corresponding respectively to the inlet and the outlet ports.

5. An absorption spectroscopy apparatus according to claim 4, further comprising:
 - a source for directing energy against the source reflector; and
 - a detector for receiving energy from the detector reflector.
6. An absorption spectroscopy apparatus according to claim 1, further comprising an intermediate reflector positioned with respect to the port of the cell and the emitter/detector reflector to reflect energy from the emitter/detector reflector through the port of the cell and against the predetermined location on the reflective surface of the side wall of the cell.
7. An absorption spectroscopy apparatus according to claim 1, further comprising end walls closing ends of the side wall of the cell.
8. An absorption spectroscopy apparatus according to claim 7, wherein the end walls have reflective surfaces facing inwardly with respect to the cell.
9. An absorption spectroscopy apparatus according to claim 8, wherein the reflective surfaces of the end walls are polished.
10. An absorption spectroscopy apparatus according to claim 7, wherein the end walls are molded.
11. An absorption spectroscopy apparatus according to claim 7, wherein the end walls include the fluid inlet and the fluid outlet of the apparatus.
12. An absorption spectroscopy apparatus according to claim 1, wherein the side wall is molded.
13. An absorption spectroscopy apparatus according to claim 1, wherein the reflective surface of the side wall is polished.
14. An absorption spectroscopy apparatus according to claim 1, further comprising a light transmissive window positioned within the port of the side wall.

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15. An absorption spectroscopy apparatus according to claim 1, wherein the cell has a height measured in a direction parallel to the axis substantially equal to a source length.

16. An absorption spectroscopy apparatus according to claim 1, further comprising:
a source for directing energy against the at least one source/detector reflector; and
a detector for receiving energy from the at least one source/detector reflector.

17. An absorption spectroscopy apparatus according to claim 1, wherein a energy path in the cell is substantially perpendicular to the cell axis.

18. An absorption spectroscopy apparatus according to claim 1, wherein the port of the side wall of the cell comprises a single inlet/outlet port, and the source/detector reflector comprises a single source/detector reflector, and the apparatus further comprises a source for directing energy against the source/detector reflector, and a detector for receiving energy from the source/detector reflector.

19. An absorption spectroscopy apparatus according to claim 1, further comprising a source for directing energy against the at least one source/detector reflector, wherein the source provide infrared energy.

20. An absorption spectroscopy apparatus according to claim 1, wherein the source/detector reflector comprises a segment of a cylinder.

21. An absorption spectroscopy apparatus according to claim 1, wherein the source/detector reflector is polished.

22. An absorption spectroscopy apparatus according to claim 1, wherein the source/detector reflector is molded.

23. (New) A sample cell for an absorption spectroscopy apparatus comprising:
at least one side wall having,

a reflective surface facing inwardly with respect to an axis of the sample cell such that a beam of energy directed against a predetermined location on the reflective surface is reflected back and forth off the reflective surface and inside the sample cell, and

at least one port; and

end walls closing opposing ends of the side and having substantially flat reflective surfaces facing inwardly with respect to the cell and extending substantially normal with respect to the axis such that a beam of energy reflected back and forth off the reflective surface of the side wall and inside the sample cell remains in substantially the same plane while inside the cell.

24. (New) A sample cell according to claim 23, wherein the reflective surfaces of the end walls are polished.

25. (New) A sample cell according to claim 23, wherein the end walls are molded.

26. (New) A sample cell according to claim 23, wherein the reflective surface of the side wall is curved.

27. (New) A sample cell according to claim 23, wherein the reflective surface of the side wall has a circular profile in a plane extending parallel with the reflective surfaces of the end walls of the cell.

28. (New) A sample cell according to claim 23, wherein the reflective surface of the side wall has a flat profile in a plane extending parallel to the axis of the cell.

29. (New) A sample cell according to claim 23, wherein the side wall is molded.

30. (New) A sample cell according to claim 23, wherein the reflective surface of the side wall is polished.

31. (New) A sample cell according to claim 23, further comprising a light

transmissive window positioned within the port of the side wall.

32. (New) A sample cell according to claim 23, wherein the cell has a height measured in a direction parallel to the axis substantially equal to a source length.

33. (New) An absorption spectroscopy apparatus including a sample cell according to claim 23, and further comprising at least one source/detector reflector having a curved profile in a plane extending perpendicular to the axis of the sample cell, the reflector positioned with respect to the port of the side wall of the sample cell to reflect energy through the port and against the predetermined location on the reflective surface of the side wall.

34. (New) An absorption spectroscopy apparatus according to claim 33, wherein the port of the side wall of the sample cell comprises inlet and outlet ports, and the source/detector reflector comprises separate source and detector reflectors corresponding respectively to the inlet and the outlet ports.

35. (New) An absorption spectroscopy apparatus according to claim 34, further comprising:

a source for directing energy against the source reflector; and

a detector for receiving energy from the detector reflector.

36. (New) An absorption spectroscopy apparatus according to claim 33, further comprising an intermediate reflector positioned with respect to the port of the side wall of the sample cell and the emitter/detector reflector to reflect energy from the emitter/detector reflector through the port of the cell and against the predetermined location on the reflective surface of the side wall of the cell.

37. (New) An absorption spectroscopy apparatus according to claim 34, further comprising:

a source for directing energy against the at least one source/detector reflector; and

a detector for receiving energy from the at least one source/detector reflector.

38. (New) An absorption spectroscopy apparatus according to claim 34, wherein the port of the side wall of the cell comprises a single inlet/outlet port, and the source/detector reflector comprises a single source/detector reflector, and the apparatus further comprises a source for directing energy against the source/detector reflector, and a detector for receiving energy from the source/detector reflector.

39. (New) An absorption spectroscopy apparatus according to claim 34, further comprising a source for directing energy against the at least one source/detector reflector, wherein the source provides infrared energy.

40. (New) An absorption spectroscopy apparatus according to claim 34, wherein the source/detector reflector comprises a segment of a cylinder.

41. (New) An absorption spectroscopy apparatus according to claim 34, wherein the source/detector reflector is polished.

42. (New) An absorption spectroscopy apparatus according to claim 34, wherein the source/detector reflector is molded.

43. (New) A sample cell according to claim 23, wherein a height of the cell defined between the end walls is relatively small compared to a width of the cell defined by the at least one side wall.

44. (New) A sample cell according to claim 43, wherein the width of the cell is at least twenty times greater than the height of the cell.